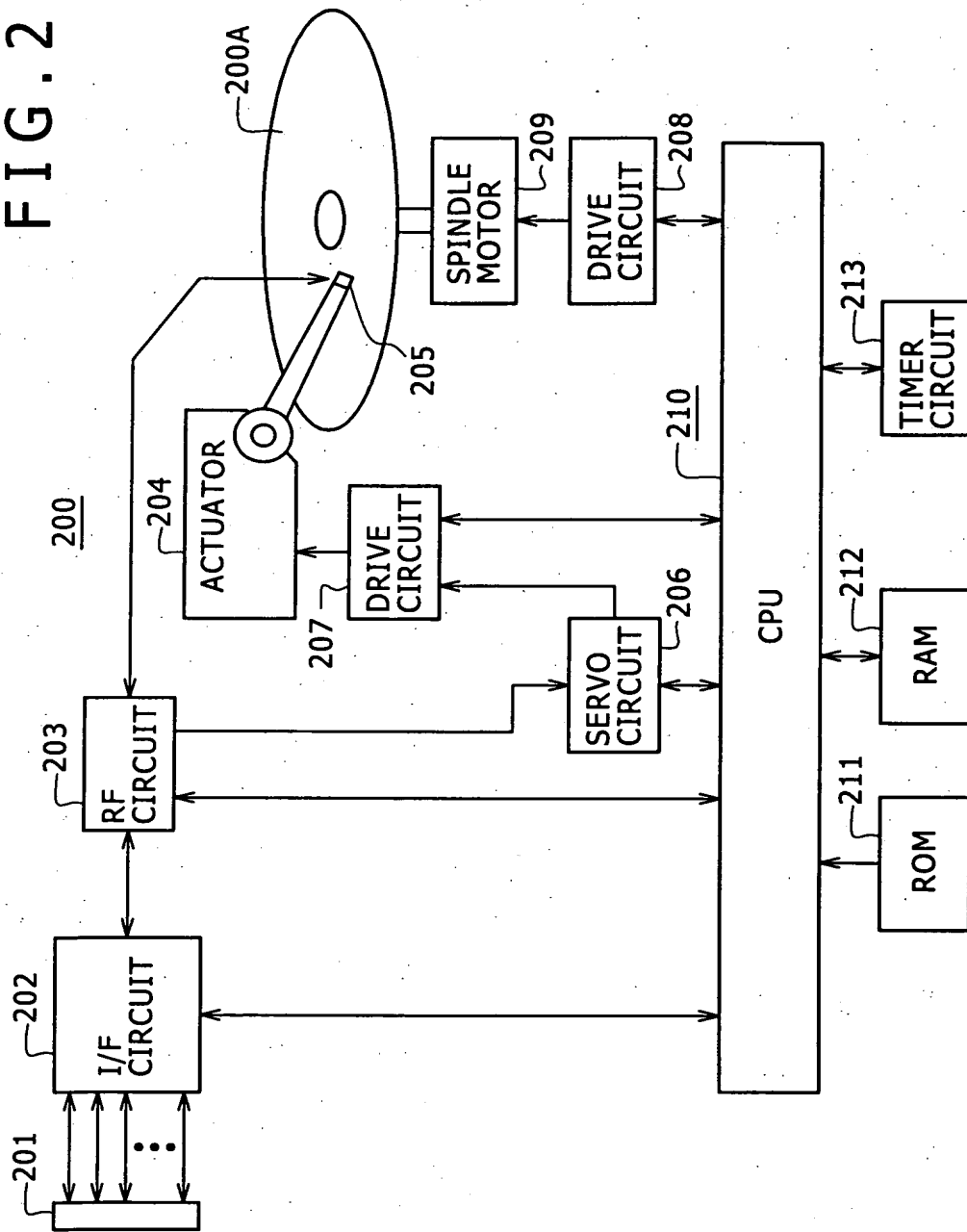# FIG. 1

FIG.2

F I G . 3

POWER SAVE MODES OF INFORMATION STORAGE DEVICE (HDD)

MODE \ CIRCUIT PORTION	IF CIRCUIT	SPINDLE	ACTUATOR	SERVO CIRCUIT	RF CIRCUIT	EXAMPLE OF POWER CONSUMPTION
ACTIVE	Enable	Rotating	Load (ON DISK)	ON	Enable	READ 2.1W WRITE 2.2W
LOW POWER ACTIVE (PERFORMANCE IDLE)	Enable	Rotating	Load (ON DISK)	ON	Disable	1.85W
ACTIVE IDLE	Enable	Rotating	Load (ON DISK)	OFF	Disable	0.95W
LOW POWER IDLE	Enable	Rotating	Parking (OUT OF DISK)	OFF	Disable	0.65W
STANDBY	Enable	Stop	Parking (OUT OF DISK)	OFF	Disable	0.25W
SLEEP	Lowest	Stop	Parking (OUT OF DISK)	OFF	Disable	0.10W

FIG.4A

10 Mbits IN TOTAL

1 SEC

(W)

WRITE (2.2 W)

(1.85 W) LOW POWER ACTIVE

(T)

0.05 SEC × 2200 mW + 0.95 SEC × 1850 mW = 1868 mW

FIG.4B

10 Mbits

1 SEC

(W)

WRITE (2.2 W)

(1.85 W)

ACTIVE IDLE (0.95 W)

MODE TRANSITION TIME

ACTIVE IDLE

10 Mbits

0.05 SEC

0.2 SEC

0.75 SEC

(T)

0.05 SEC × 2200 mW + 0.2 SEC × 1850 mW + 0.75 SEC × 950 mW = 1193 mW

FIG.5

0.05 SEC × 2200 mW + 0.95 SEC × 950 mW = 1013 mW
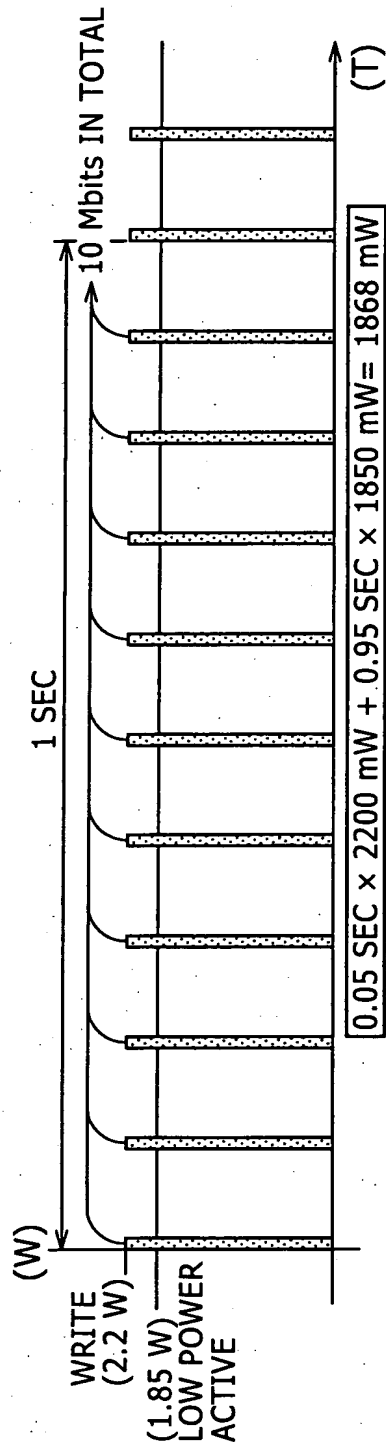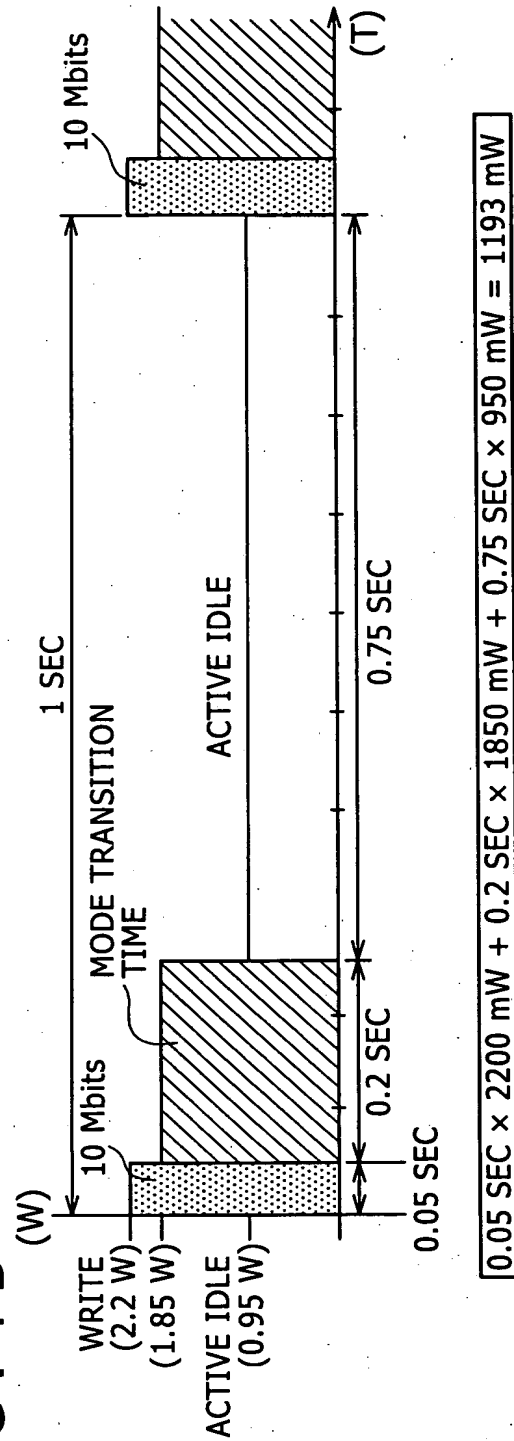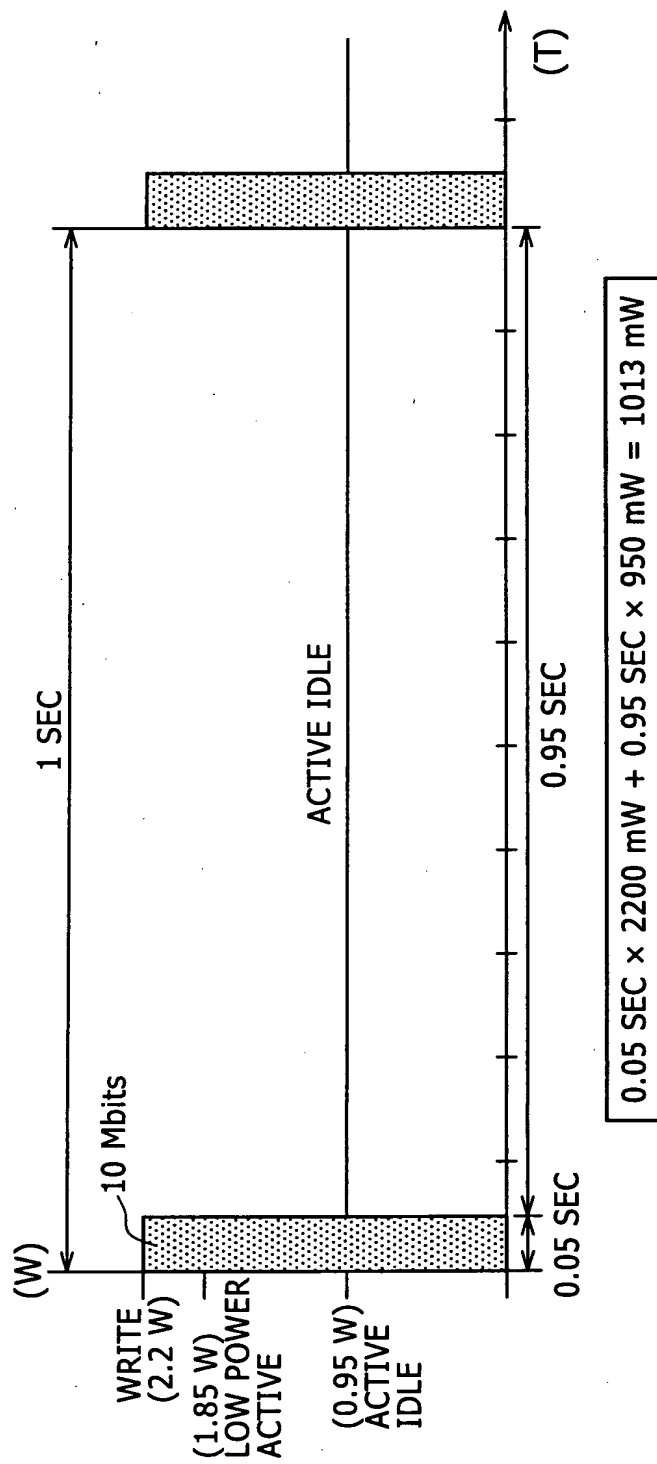
FIG.6

COMMAND CODE: EFh

REGISTERS	7	6	5	4	3	2	1	0
FEATURES	SUBCOMMAND CODE							
SECTOR COUNT	SUBCOMMAND SPECIFIC							
SECTOR NUMBER	SUBCOMMAND SPECIFIC							
CYLINDER LOW	SUBCOMMAND SPECIFIC							
CYLINDER HIGH	SUBCOMMAND SPECIFIC							
DEVICE/HEAD	obs	na	obs	DEV	na	na	na	na
COMMAND	EFh							

obs : obsolete   na : not applicable

FIG.7

	VALUE	DESCRIPTION
	01h	Enable 8-bit PIO transfer mode
	02h	Enable write cache
	03h	Set transfer mode based on value in Sector Count register
	04h	Obsolete
	05h	Enable Advanced Power Management
	⋮	⋮
*	25h	Enable Direct Power Management
*	26h	Set Host Controlled Advanced Power Management
	⋮	⋮
	85h	Disable Advanced Power Management
	⋮	⋮
*	A5h	Disable Direct Power Management
	⋮	⋮

SET FEATURES COMMAND

F I G . 8 A

REGISTERS	7	6	5	4	3	2	1	0	
FEATURES	0	0	1	0	0	1	0	1	(25h)
DEVICE/HEAD	1	0	1	0	0	0	0	0	(A0h)
COMMAND	1	1	1	0	1	1	1	1	(EFh)

F I G . 8 B

REGISTERS	7	6	5	4	3	2	1	0	
FEATURES	1	0	1	0	0	1	0	1	(A5h)
DEVICE/HEAD	1	0	1	0	0	0	0	0	(A0h)
COMMAND	1	1	1	0	1	1	1	1	(EFh)

FIG.9

COMMAND CODE: EFh

REGISTERS	7	6	5	4	3	2	1	0
FEATURES	na							
SECTOR COUNT	na							
SECTOR NUMBER	na							
CYLINDER LOW	na							
CYLINDER HIGH	na							
DEVICE/HEAD	obs	na	obs	DEV	na	na	na	na
COMMAND	E1h							

obs : obsolete   na : not applicable

FIG.10

VALUE	DESCRIPTION
00h	Active Immediate
01h	Low Power Active Immediate
02h	Active Idle Immediate
03h	Low Power Idle Immediate

IDLE IMMEDIATE COMMAND

FIG.11A

REGISTERS	7	6	5	4	3	2	1	0	
FEATURES	0	0	0	0	0	0	0	0	(00h)
DEVICE/HEAD	1	0	1	0	0	0	0	0	(A0h)
COMMAND	1	1	1	0	0	0	0	1	(E1h)

FIG.11B

REGISTERS	7	6	5	4	3	2	1	0	
FEATURES	0	0	0	0	0	0	0	1	(01h)
DEVICE/HEAD	1	0	1	0	0	0	0	0	(A0h)
COMMAND	1	1	1	0	0	0	0	1	(E1h)

FIG.11C

REGISTERS	7	6	5	4	3	2	1	0	
FEATURES	0	0	0	0	0	0	1	0	(02h)
DEVICE/HEAD	1	0	1	0	0	0	0	0	(A0h)
COMMAND	1	1	1	0	0	0	0	1	(E1h)

FIG.11D

REGISTERS	7	6	5	4	3	2	1	0	
FEATURES	0	0	0	0	0	0	1	1	(03h)
DEVICE/HEAD	1	0	1	0	0	0	0	0	(A0h)
COMMAND	1	1	1	0	0	0	0	1	(E1h)

FIG.12A

COMMAND CODE: E5h

REGISTERS	7	6	5	4	3	2	1	0
FEATURES	na							
SECTOR COUNT	na							
SECTOR NUMBER	na							
CYLINDER LOW	na							
CYLINDER HIGH	na							
DEVICE/HEAD	obs	na	obs	DEV	na	na	na	na
COMMAND	E5h							

obs : obsolete   na : not applicable

FIG.12B

REGISTERS	7	6	5	4	3	2	1	0
ERROR	na							
SECTOR COUNT	Result Value							
SECTOR NUMBER	na							
CYLINDER LOW	na							
CYLINDER HIGH	na							
DEVICE/HEAD	obs	na	obs	DEV	na	na	na	na
STATUS	BSY	DRDV	DF	na	DRQ	na	na	ERR

obs : obsolete   na : not applicable

F I G . 1 3 A

VALUE	DESCRIPTION
00h	STANDBY MODE
80h	IDLE MODE
FFh	ACTIVE MODE OR IDLE MODE

F I G . 1 3 B

VALUE	DESCRIPTION
FFh	ACTIVE MODE
83h	LOW POWER ACTIVE MODE
82h	ACTIVE IDLE MODE
81h	LOW POWER IDLE MODE
00h	STANDBY MODE

F I G . 1 4

(W)

ACTIVE

LOW POWER ACTIVE

ACTIVE IDLE

LOW POWER IDLE

STANDBY

SLEEP

TRANSITION TIME T1

TRANSITION TIME T2

TRANSITION TIME T3

TRANSITION TIME T4

(t)
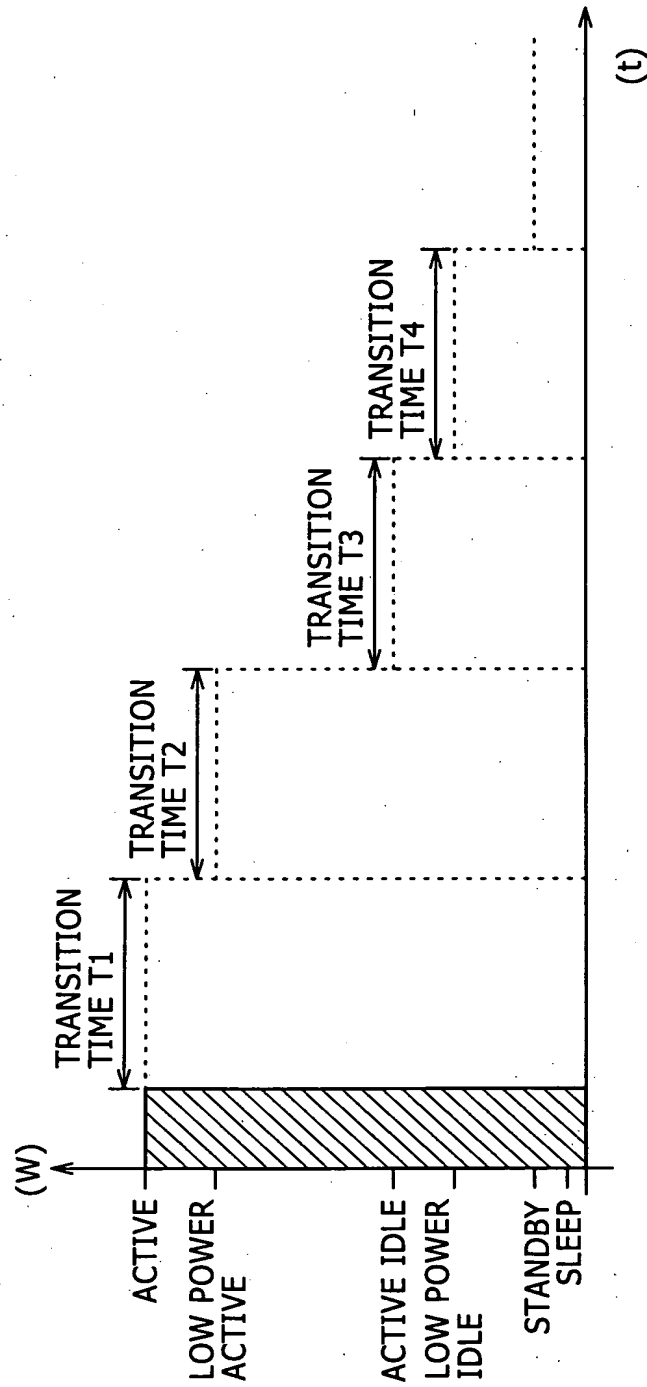
FIG.15

COMMAND CODE: EFh

REGISTERS	7	6	5	4	3	2	1	0
FEATURES				26h				
SECTOR COUNT			(00h ~ 03h)					
SECTOR NUMBER			(00h ~ FFh)					
CYLINDER LOW				na				
CYLINDER HIGH				na				
DEVICE/HEAD	obs	na	obs	DEV	na	na	na	na
COMMAND				EFh				

obs : obsolete   na : not applicable

FIG.16

VALUE	DESCRIPTION
00h	SPECIFY TRANSITION TIME FROM ACTIVE TO LOW POWER ACTIVE
01h	SPECIFY TRANSITION TIME FROM LOW POWER ACTIVE TO ACTIVE IDLE
02h	SPECIFY TRANSITION TIME FROM ACTIVE IDLE TO LOWER POWER IDLE
03h	SPECIFY TRANSITION TIME FROM LOWER POWER IDLE TO STANDBY
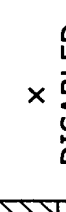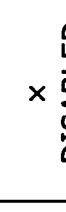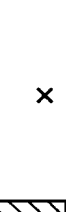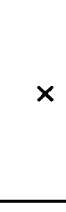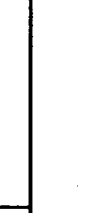
FIG.17

VALUE IN SECTOR NUMBER REGISTER $\times$ 40 msec = SET TIME $\cdots$(1)

FIG. 18

LIST OF POWER CONSUMPTION CONTROL FUNCTIONS

SETTING			OPERATION			
SETTING OF DIRECT POWER MANAGEMENT	SETTING OF STANDBY TIMER	SETTING OF ADVANCED POWER MANAGEMENT FOR PC	STADBY TIMER	ADVANCED POWER MANAGEMENT FOR PC	HOST CONTROLLED ADVANCED POWER MANAGEMENT	DIRECT POWER MANAGEMENT
DISABLED (DEFAULT)	DISABLED (DEFAULT)	ENABLED (DEFAULT)	× DISABLED	○ ENABLED APM Mode 0	× DISABLED	× DISABLED
DISABLED (DEFAULT)	ENABLED	ENABLED (DEFAULT)	○ ENABLED	○ ENABLED APM Mode 0	× DISABLED	× DISABLED
DISABLED (DEFAULT)	DISABLED (DEFAULT)	DISABLED	× DISABLED	× DISABLED	○ ENABLED	○ ENABLED
DISABLED (DEFAULT)	ENABLED	DISABLED	○ ENABLED	× DISABLED	○ ENABLED	○ ENABLED

FIG.19

```
           ┌─────────────┐
           │    START    │
           └──────┬──────┘
                  │        ┌─S101
      ┌───────────▼──────────────┐
      │ CONTROL POWER CONSUMPTION │
      │ MODE BY APM FUNCTION      │
      └───────────┬───────────────┘
                  │    ┌─S102
             ╱────▼────╲
            ╱  ENABLING  ╲      NO
           ◄  DPM FUNCTION ►────────┐
            ╲ INSTRUCTED? ╱         │
             ╲────┬────╱            │
                YES                 │
                  │  ┌─S103         │
      ┌───────────▼──────────────┐  │
      │ ENABLE DPM FUNCTION AND  │  │
      │ HCAPM FUNCTION, AND STOP │  │
      │ APM FUNCTION             │  │
      └───────────┬──────────────┘  │
                  │    ┌─S104        │
             ╱────▼────╲             │
            ╱ DISABLING  ╲    NO     │
           ◄ DPM FUNCTION ►──────┐   │
            ╲ INSTRUCTED? ╱      │   │
             ╲────┬────╱         │   │
                YES              │   │
                  │ ┌─S105       │   │
      ┌───────────▼──────────┐   │   │
      │ DISABLE DPM FUNCTION │   │   │
      │ AND HCAPM FUNCTION   │   │   │
      └───────────┬──────────┘   │   │
                  └──────────────┴───┘
```

FIG.20

START

S101

ISSUE CHECK POWER MODE
COMMAND FROM INFORMATION
PROCESSING UNIT

S202

ACCEPT CHECK POWER MODE
COMMAND AT HDD

S203

DPM FUNCTION
ENABLED?

NO

YES

S204

SET POWER CONSUMPTION
MODE AS RETURN VALUE FOR
CHECK POWER MODE COMMAND
AT DETAILED LEVEL

S205

SET POWER
CONSUMPTION MODE
AS RETURN VALUE
FOR CHECK POWER
MODE COMMAND
AT ROUGH LEVEL

S206

REFER TO RETURN VALUE AT
INFORMATION PROCESSING UNIT

END